

**City of Milwaukee Health Department  
Division of Disease Control and Prevention  
Watershed Monitoring Report  
2006**

**Purpose and Strategy**

The waters of the Milwaukee River Watershed have been monitored by the City of Milwaukee Health Department (MHD) for *Cryptosporidium* and *Giardia* since 1994. The Watershed monitoring strategy has changed over the years as questions about *Cryptosporidium* and *Giardia* occurrence and distribution were answered and new questions arose.

In the past, samples were collected from the Milwaukee River and other sites. Because *Cryptosporidium* and *Giardia* concentrations in samples from the Milwaukee River Confluence were shown to be representative of the other sites then monitored, sampling from those other river sites, followed by other Milwaukee River sites, was discontinued. Currently, the purpose of monitoring is to track the occurrence and concentration of *Cryptosporidium* in waters (the River Confluence and diverted Waste Water Treatment Plant effluent) that are believed to potentially influence source water quality.

**Environment**

The River Confluence is comprised of three tributary rivers-the Milwaukee, Menomonee and Kinnickinnic, which are influenced by stormwater, other run-off, agriculture (Milwaukee and Menomonee) and upstream sewage treatment plants (Milwaukee River only). In addition, combined sewer and/or sanitary overflows, and/or Waste Water Treatment Plant diversions may occur during extensive rainy weather and may affect River Confluence water quality.

The waters of the River Confluence are subsequently greatly diluted by the waters of Lake Michigan. The intakes for the Linnwood and Howard Water Purification Plants are each located approximately 1 mile off-shore in Lake Michigan, where the effects of the Confluence, surface run-off, stormwater, combined and/or separate sewer overflows, and waste water effluent are greatly reduced. Source water at the two Water Purification Plants is monitored for *Cryptosporidium* and *Giardia* twice per month by Milwaukee Water Works.

**Results**

Results (see attached Table) from samples collected in 2006 were similar to those of previous years. *Cryptosporidium* was infrequently detected. *Giardia* was detected in 7 of 8 samples from the River Confluence in 2005, a frequency of detection that is similar to that of previous years. Ranges for *Cryptosporidium* and *Giardia* were similar to the ranges detected in samples collected during 2001-2005. One Waste Water Treatment Plant diversion occurred during the 2006 monitoring season (March 29 through October 12). This diverted Waste Water effluent sample collected in 2006 contained 214 *Giardia* cysts per Liter (2001-6 range=8.8-500.3 cysts/L) and no *Cryptosporidium*.

1-8-07

## **Discussion**

The *Cryptosporidium* and *Giardia* contribution from the River Confluence to Lake Michigan and source water in 2006 was similar in frequency and concentration to that of previous years. *Cryptosporidium* and *Giardia* levels detected in samples from the River Confluence 2001-2006 when detected, were relatively low. *Giardia* detected in Waste Water effluent was within range of that detected in previous years. *Cryptosporidium* was not detected in diverted waste water in 2006. It is not surprising that extremely low levels of *Cryptosporidium* and *Giardia* are detected, very rarely (data not shown here), in source water.

Most of the *Cryptosporidium* in samples collected from the River Confluence and analyzed by the Centers for Disease Control and Prevention in 1999-2001 were of a species not known to infect humans but rather those known to infect waterfowl or other wildlife.

For the past several years, information about the morphology of *Cryptosporidium* and *Giardia* detected in River Confluence samples has been gathered (data not shown here). Some of the oocysts/cysts appeared to have the organization, genetic material and structural integrity (though integrity does not guarantee the oocyst/cyst can cause an infection in a human) necessary support infection of a new host such as a human, but most oocysts and cysts did not.

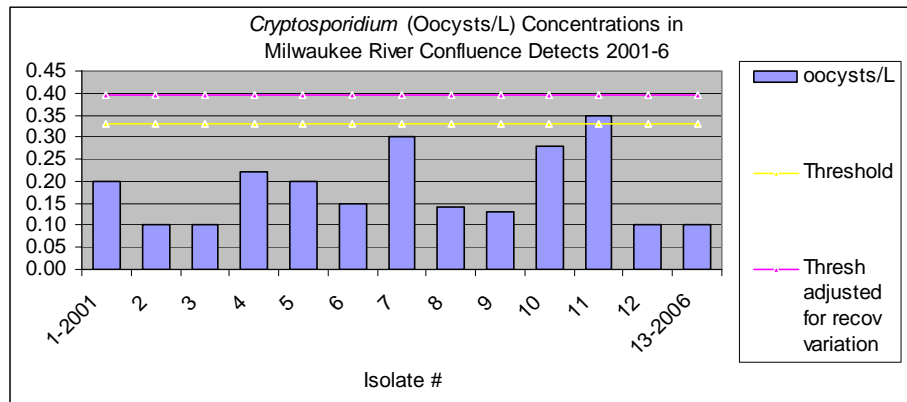
In summary, monitoring results from the River Confluence show that very low levels of *Cryptosporidium* and *Giardia* may affect source water quality. These very low levels are likely to appear even less significant as a challenge to drinking water purification (removal or inactivation of *Cryptosporidium* and *Giardia*) when it is considered that the ability of these organisms to actually establish infections in a human does not exist in all oocysts/cysts.

## **Plans for 2007**

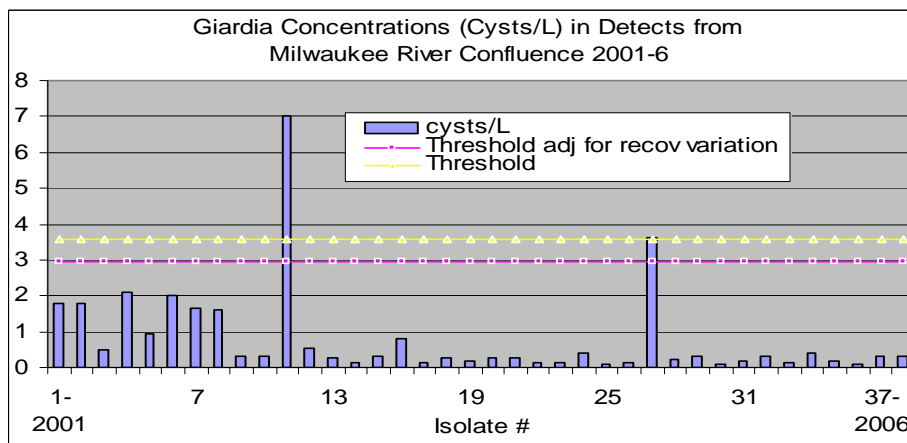
Testing of the River Confluence every other month from March through October will occur in order to track occurrence and concentration of *Cryptosporidium* and *Giardia*, and to watch for upward trends or spikes in frequency of occurrence or in concentration of either organism (see Graph A and B below). A concentration of *Cryptosporidium* or *Giardia* that exceeds the Threshold (Geometric Mean plus twice the Standard Deviation, plus a percentage allowed for recovery variation) will trigger review of other available environmental data to determine if a *Cryptosporidium* or *Giardia* source has been introduced or enhanced. If a Waste Water Treatment Plant diversion occurs, a sample will be collected and analyzed for *Cryptosporidium* and *Giardia* content.

1-8-07

**Table A *Cryptosporidium* Threshold**



**Table B. *Giardia* Threshold**



1-8-07

**Table: *Cryptosporidium* and *Giardia* Monitoring Results from 2001-2005**  
**(NT=Not Tested; nd=not detected)**

<i>Crypto</i> Oocysts/L	DIV WW EFF	CONFL	<i>Giardia</i> Cysts/L	DIV WW EFF	CONFL
2/15/2001	NO SAMPLING OF DIVERSIONS	0.20	2/15/2001	NO SAMPLING OF DIVERSIONS	1.80
3/12/2001		nd	3/12/2001		1.80
3/21/2001		0.10	3/21/2001		0.50
3/28/2001		0.10	3/28/2001		2.10
4/4/2001		nd	4/4/2001		0.95
4/11/2001		0.22	4/11/2001		2.00
4/25/2001		nd	4/25/2001		1.65
6/20/2001		0.20	6/20/2001		1.60
6/27/2001		nd	6/27/2001		0.30
8/22/2001		nd	8/22/2001		nd
9/26/2001		0.15	9/26/2001		0.30
<b>AVG (RANGE)</b>		<b>0.16 (0.10-0.22)</b>	<b>AVG (RANGE)</b>		<b>1.30 (0.5-2.1)</b>
2/12/2002	NO SAMPLING OF DIVERSIONS	0.30	2/12/2002	NO SAMPLING OF DIVERSIONS	7.00
3/7/2002		nd	3/7/2002		nd
4/17/2002		nd	4/17/2002		0.53
5/16/2002		nd	5/16/2002		nd
6/19/2002		nd	6/19/2002		nd
7/23/2002		nd	7/23/2002		nd
7/29/2002		nd	7/29/2002		nd
9/11/2002		0.14	9/11/2002		0.28
10/9/2002		nd	10/9/2002		0.15
10/16/2002		nd	10/16/2002		0.30
10/23/2002		nd	10/23/2002		0.82
<b>AVG (RANGE)</b>		<b>0.22 (0.14-0.30)</b>	<b>AVG (RANGE)</b>		<b>1.51 (0.15-7.00)</b>
3/19/2003	NO DIVERSIONS	0.13	3/19/2003	NO DIVERSIONS	0.13
4/8/2003		nd	4/8/2003		nd
4/15/2003	NO DIVERSIONS	nd	4/15/2003	NO DIVERSIONS	nd
5/1/2003	1.1	NT	5/1/2003	500.3	NT
5/22/2003	NO DIVERSIONS	nd	5/22/2003	NO DIVERSIONS	nd
6/26/2003		nd	6/26/2003		0.28
7/17/2003		nd	7/17/2003		nd
9/3/2003		nd	9/3/2003		nd
10/7/2003		nd	10/7/2003		nd
11/24/2003		nd	11/24/2003		0.16
12/10/2003	nd	NT	12/10/2003	273.8	NT
<b>AVG (RANGE)</b>	<b>1.1</b>	<b>0.13 (0.13)</b>	<b>AVG (RANGE)</b>	<b>273.8-500.3</b>	<b>0.19 (0.13-0.28)</b>
3/11/2004	NO DIVERSIONS	nd	3/11/2004	NO DIVERSIONS	0.27
3/26/04	nd	NT	3/26/04	8.8	NT
4/14/2004	NO DIVERSIONS	nd	4/14/2004	NO DIVERSIONS	nd
5/14/04	nd	NT	5/14/04	117.8	NT
5/18/2004	NO DIVERSIONS	0.28	5/18/2004	NO DIVERSIONS	0.28
6/23/2004		nd	6/23/2004		0.13
7/21/2004		nd	7/21/2004		0.14
8/25/2004		nd	8/25/2004		nd
9/8/2004		nd	9/8/2004		0.38
10/13/2004		nd	10/13/2004		0.10
<b>AVG (RANGE)</b>	<b>nd</b>	<b>0.28 (0.28)</b>	<b>AVG (RANGE)</b>	<b>8.8-117.8</b>	<b>0.22 (0.10-0.38)</b>

1-8-07

**Table: *Cryptosporidium* and *Giardia* Monitoring Results from 2001-2005**  
(NT=Not Tested; nd=not detected)

<i>Crypto</i> Oocysts/L	DIV WW EFF	CONFL	<i>Giardia</i> Cysts/L	DIV WW EFF	CONFL
3/9/2005	NO DIVERSIONS	0.35	3/9/2005	NO DIVERSIONS	0.12
4/27/2005		nd	4/27/2005		3.50
5/26/2005		nd	5/26/2005		0.22
6/22/2005		nd	6/22/2005		0.30
7/13/2005		0.10	7/13/2005		nd
8/25/2005		nd	8/25/2005		0.10
9/22/2005		nd	9/22/2005		nd
10/19/2005		nd	10/19/2005		0.20
<b>AVG (RANGE)</b>	NO DIVERSIONS	<b>0.23 (0.10-0.35)</b>	<b>AVG (RANGE)</b>	NO DIVERSIONS	<b>0.74 (0.12-3.50)</b>
3/29/06	nd	nd	3/29/06	214	nd
4/26/05	NO DIVERSIONS	nd	4/26/05	NO DIVERSIONS	0.33
5/24/2006		nd	5/24/2006		0.13
6/21/2006		nd	6/21/2006		0.40
7/24/2006		0.10	7/24/2006		0.20
8/16/2006		nd	8/16/2006		0.10
9/13/2006		nd	9/13/2006		0.30
10/12/2006		0.10	10/12/2006		0.30
<b>AVG (RANGE)</b>		<b>0.10 (0.10-0.10)</b>	<b>AVG (RANGE)</b>		<b>0.25 (0.10-0.40)</b>
<b>01-Present AVG (RANGE)</b>	1.1 (1.1)	0.17 (0.10-0.35)	<b>01-Present AVG (RANGE)</b>	222.9 (8.8-500.3)	0.77 (0.10-3.50)
<b>01-06 GM</b>	Not Enough Data for Stat	0.16	<b>01-06 GM</b>	Not Enough Data for Stat	0.39
<b>01-06 Threshold</b>		0.33	<b>01-06 Threshold</b>		2.97

## Partners

The City of Milwaukee Health Department wishes to thank the following for their assistance in Watershed Monitoring efforts:

Milwaukee Water Works  
Milwaukee Metropolitan Sewerage District  
Wisconsin State Laboratory of Hygiene  
Water-Health Technical Subcommittee